



## The Implementation of Local Wisdom-Based Teaching Material to Increase Students' Literacy and Numeracy

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### Abstract

This study aims to analyze of the availability of local wisdom-based teaching materials today, the characteristics, validity, readability, effectiveness, and practicality of local wisdom-based teaching materials on the topic of Sound Waves to increasing literacy and numeracy students'. The research design used was called research and development (R&D) with a product trial design using a quasi-experimental design. The research was conducted on students of 11th grade at High School at Bandar Lampung. Data analysis techniques using descriptive, percentages, normalized gains  $\langle g \rangle$ , and t-test. Based on research data analysis, it was found that the results of the literature review using VOSviewer reflect that local wisdom-based education is not only seen as a cultural approach, but has also moved towards integration with 21<sup>st</sup> century basic competencies. Temporal visualization also shows a shift from a conceptual approach to the development of more applicable learning tools and learning strategies. This condition underlies the development of local wisdom-based teaching materials. The materials significantly improved students' literacy and numeracy, with the experimental group achieving a high effectiveness category,  $\langle g \rangle = 0.70$ , compared to the control group's low effectiveness,  $\langle g \rangle = 0.17$ . Statistical analysis confirmed the significance of the improvement, with the t calculation of 9,41. Practicality tests indicated a very practical rating from teachers (93.5%) and a practical rating from students (84%). The study's findings indicate that the implementation of local wisdom into teaching materials represents a promising strategy for enhancing student learning outcomes and aligning instructional practices with cultural and educational goals.

### How to Cite

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## INTRODUCTION

Literacy is one of the important indicators in assessing the quality of education in a country. The government's effort to comprehensively capture the quality of learning processes and outcomes of primary and secondary education units nationally is by implementing a national assessment called the Asesmen Kompetensi Minimum (AKM). AKM includes several assessments of basic literacy components that must be mastered by students. Citing data from Kementerian Pendidikan dan Kebudayaan, the six basic literacies include 1) reading and writing literacy, 2) numeracy literacy, 3) science literacy, 4) digital literacy, 5) financial literacy, and 6) cultural and civic literacy.

Based on Rapor Pendidikan Indonesia 2024, the literacy level of Indonesian students is still in the average level category, which still needs to be improved by habituate reading activities along with two-way discussions about the reading to train critical thinking skills and increase interaction between teachers/parents and children. Comparable to the numeracy results of students who are still classified in the average category and can still be improved by encouraging children to use various mathematical principles to solve everyday problems (Kemdikbudristek, 2024).

The result of team's analysis from Pusat Penelitian Pendidikan (2021) showed that basic literacy is influenced by factors, such as 1) students' enjoyment of reading, 2) reading metacognition strategies, 3) classroom discipline culture, and 4) teachers' teaching strategies in affecting students' enjoyment of reading. In the teaching aspect, innovation and also novelty can be carried out in the form of using teaching materials that are specifically designed to improve student literacy. One form of improving the quality of learning is by providing adequate reading materials, one of which is the procurement of teaching materials that can accommodate the needs in improving student literacy. Teaching materials that are specifically designed and compiled by paying attention to student needs have the potential to improve students' numeracy literacy skills (Pratidina & Novaliyosi, 2024). Research by Rusilowati et al., (2021) on the development of ethno-science integrated teaching materials can show an increase in students' scientific literacy compared to other teaching materials.

Local wisdom, as a vital component of cultural heritage, offers valuable potential as a contextualized learning resource. It provides content that is familiar and relevant to students' daily

lives, thereby linking scientific knowledge with socio-cultural realities (Ramdani, 2018). The integration of local wisdom into the domain of science education has the potential to enhance the learning experience, rendering it more meaningful and engaging.

Recent studies lend support to the integration of local wisdom in science learning, due to its ability to deepen conceptual understanding and strengthen cultural identity. For instance, Iriani et al. (2022) demonstrated that local wisdom enhances students' critical and creative thinking skills. The study reported a substantial increase in both skills, highlighting the positive impact of local wisdom in education. In a similar context, Taufiq et al. (2023) research demonstrated that the utilization of local wisdom-based materials can significantly improve physics learning outcomes. Study from Utami et al. (2020) showed the integration of cultural context into physics education was shown to enhance comprehension and relevance of the subject matter. Other study done by Laos & Tefu (2020) concluded that local wisdom-integrated teaching materials are effective in improving students' analytical abilities in physics. However, these studies have not adequately addressed the development of literacy and numeracy. Research by Langtang & Mataubenu (2019) explored local wisdom in physics learning, but practical classroom-ready materials have yet to be developed.

Despite the implementation of numerous initiatives aimed at enhancing educational outcomes in Indonesia, national and international assessments, including AKM and PISA, have repeatedly indicated that the literacy and numeracy competencies of students persist at levels that fall short of the established benchmarks. This finding suggests a persistent gap in students' ability to comprehend, apply, and reflect upon academic content in ways that are relevant to their everyday lives. A significant contributing factor is the absence of contextual and meaningful teaching materials that integrate scientific concepts with students' cultural backgrounds.

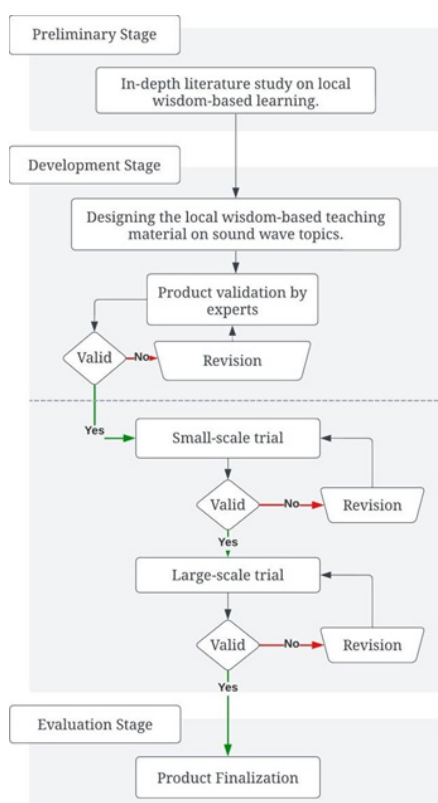
This study fills the gap that exists in the practical implementation of local wisdom-based teaching materials. This study makes a novel contribution to the field of science education by developing practical, classroom-ready teaching materials that are specifically designed to integrate local wisdom with a focus on enhancing students' reading literacy, and numeracy—simultaneously. In contrast to previous studies, which have predominantly emphasized conceptual understanding or academic achievement in general, this

research explicitly targets the two core literacies that are prioritized in national assessments.

This study aims to (1) analyze the availability of local wisdom-based teaching materials at present, (2) analyze the characteristics of the teaching materials developed, (3) test the validity of the teaching materials, (4) test their readability, (5) effectiveness, and (6) practicality of using local wisdom-based teaching materials on the topic of Sound Waves.

## METHOD

The research design employed in this study is research and development (R&D), utilizing a product trial in a quasi-experimental design. The R&D process consists of multiple stages, including the preliminary study stage, the development stage and the evaluation stage. The detail research design is shown in Figure 1.



**Figure 1.** Research procedure (Putri et al., 2024)

The preliminary study stage conducted by giving questionnaires completed by teachers and by doing bibliometric analysis from the Crossref database with the help of the Publish or Perish application. Crossref was chosen because it provides metadata of reputable scientific publications that have DOIs, covering various international

and national journals. A total of 839 articles were collected and analyzed. The search results produced a number of documents which were then visualized by VOSviewer.

At the development stage, 3 different groups have been selected from students of 11th grade at High School for participating in this study, experimental group, control group, and product trial group. At this stage, local wisdom-based learning approach is combined with the syntax of discovery learning model shown in Table 1.

**Table 1.** Discovery learning syntax used in local wisdom-based learning approach

Stage	Teacher and Students Activities
Stimulation	The teacher provides engaging phenomena related to the topic. Students listen, read, or see an interesting demonstration of local wisdom experiments.
Problem statement or identification	Students discuss phenomena and formulate problems related to the topic. Students formulate hypotheses and initial assumptions (collect possible theories).
Data collection	Students conduct experiments, observations, or literature reviews.
Data processing	Students interpret all data from the findings to produce a new finding.
Evidence	Students compare the data results with the hypothesis that has been made and examine whether the hypothesis is accepted or not.
Generalization or draw conclusions	Students analyze the hypotheses they get and give their opinions about the conclusions of the solutions to the problems presented or found.

Table 1 outlines the instructional syntax used in the implementation of the local wisdom-based sound wave teaching materials. It presents a structured sequence of learning activities aligned with the Discovery Learning model, including both teacher and student roles at each stage. This syntax provides a practical guide for achieving the intended learning goals and ensuring consistency in classroom application.

## RESULT AND DISCUSSION

The research results include: analyzing the availability of local wisdom-based teaching materials at present, analyzing the characteristics of the teaching materials developed, testing the validity of the teaching materials, readability, effec-

tiveness, and practicality of using local wisdom-based teaching materials.

### Analyzing the availability of local wisdom-based teaching materials at present

Interviews that have been conducted in the preliminary research with teachers from several schools said that teaching material that support students' literacy and numeracy skills are still inadequate. This lack of learning resources is one of the factors that affect students' literacy levels which are quite low (Hapsari, 2019). The development and use of teaching materials or media in learning has the potential to improve students' numeracy literacy skills both at elementary, junior high and high school levels (Pratidina & Novaliyosi, 2024). Some teaching materials found in the school have not really emphasized the features that support literacy.

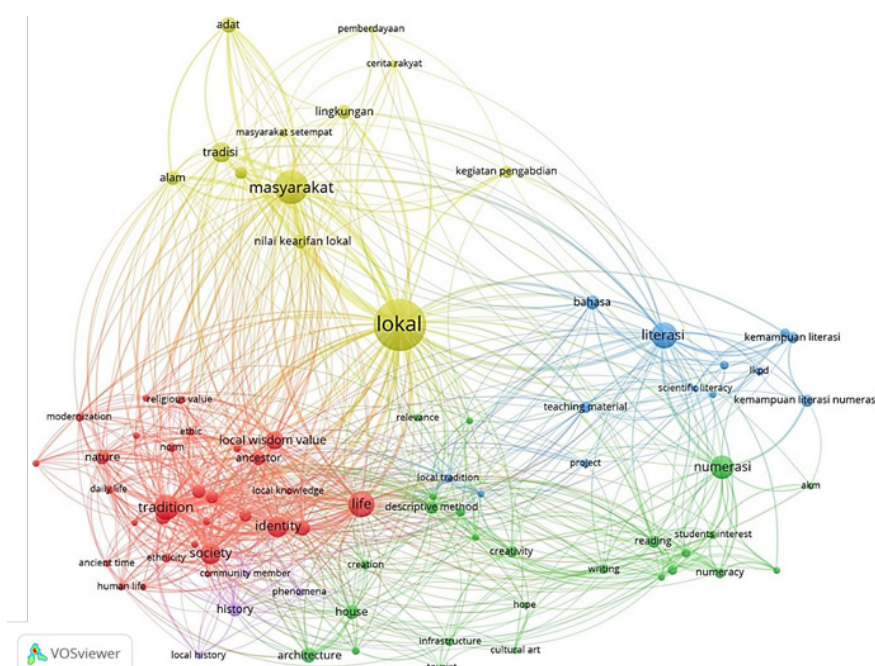
Research by Langtang & Mataubenu (2019) has been able to identify the potential of local wisdom-based learning in the context of physics, but has not been developed into applicable teaching materials. This is in accordance with research by Sahara et al. (2022) which suggested the development of teaching materials based on local wisdom. Supporting this opinion, a bibliometric analysis was conducted with keywords such as "budaya" or "kearifan lokal" combined with the terms "literasi" and "numerasi", to gather literature relevant to the theme of local wisdom-based education. Based on the bibliometric

analysis from 839 articles, a total of 84 unique keywords were found. From all these keywords, the VOSviewer system formed four main clusters that show the thematic pattern of research. Ten most frequently occurring keywords (Table 2.)

**Table 2.** The most keywords shown in 2020-2025 publications related to culture, local wisdom, literacy, and numeracy

	Keywords	Occ.	Cluster Color
1	lokal	280	Yellow
2	masyarakat	219	Yellow
3	literasi	73	Blue
4	life	69	Red
5	tradition	65	Red
6	numerasi	56	Green
7	society	47	Red
8	identity	45	Red
9	tradisi	42	Yellow
10	local wisdom value	37	Red

The keywords local, community and literacy occupy the top three positions, indicating that strengthening literacy through cultural identity and community engagement through educational approaches based on local values are the dominant focus in publications. Each keyword is also distributed into different clusters, indicating the diversity of approaches and perspectives in this research.



**Figure 2.** Keywords co-occurrence visualization results from 2020-2025 publications related to culture, local wisdom, literacy, and numeracy by VOSviewer.



The results of keyword co-occurrence visualization using VOSviewer in Figure 2 show the existence of four main clusters representing dominant research themes in the field of education studied in the range 2020-2025. Each color represents one thematic cluster presented in Table 3.

**Table 3.** Description of clusters in keywords co-occurrence visualization results from 2020-2025 publications related to culture, local wisdom, literacy, and numeracy

Thematic Clusters	Description
<b>The first cluster (yellow)</b> centers on keywords such as local, community, empowerment, tradition, and local wisdom values.	This cluster represents a research focus on strengthening cultural identity and community engagement through educational approaches based on local values. Research in this cluster is generally contextual and directed towards the development of science education that is in harmony with the environment and the wisdom of the local community.
<b>The second cluster (red)</b> highlights aspects of tradition, local wisdom value, identity, history, and heritage, indicating that cultural and social dimensions are an important part of educational narrative.	Research in this cluster examines how cultural heritage, local history, and traditional architecture can be integrated into the science learning process. The main focus is on identity building and preserving local values through educational media.
<b>The third cluster (blue)</b> centers in keywords such as scientific literacy, literacy skills, and teaching materials indicate that strengthening students' literacy competencies is a major concern.	This cluster shows a trend that focuses on improving literacy, both in general and in the context of science. This is in line with the challenges of the digital era that demand more complex literacy skills, including in understanding and communicating science concepts.
<b>The fourth cluster (green)</b> is closely related to the themes of numeracy, STEAM, education, and creativity.	This cluster shows great attention to the development of innovative science learning that is oriented towards 21 <sup>st</sup> century skills. This indicates that local wisdom-based education has evolved from mere cultural preservation to a multidisciplinary approach that is responsive to 21 <sup>st</sup> century learning needs.

Table 3 presents the results of the VOSviewer cluster analysis, which groups related keywords into thematic clusters based on their co-occurrence in the literature. Each cluster represents a distinct research focus or topic trend relevant to local wisdom-based education and its integration into science learning. This analysis provides insights into the dominant themes and their interconnections, which served as a reference for designing the content and features of the teaching materials developed in this study.

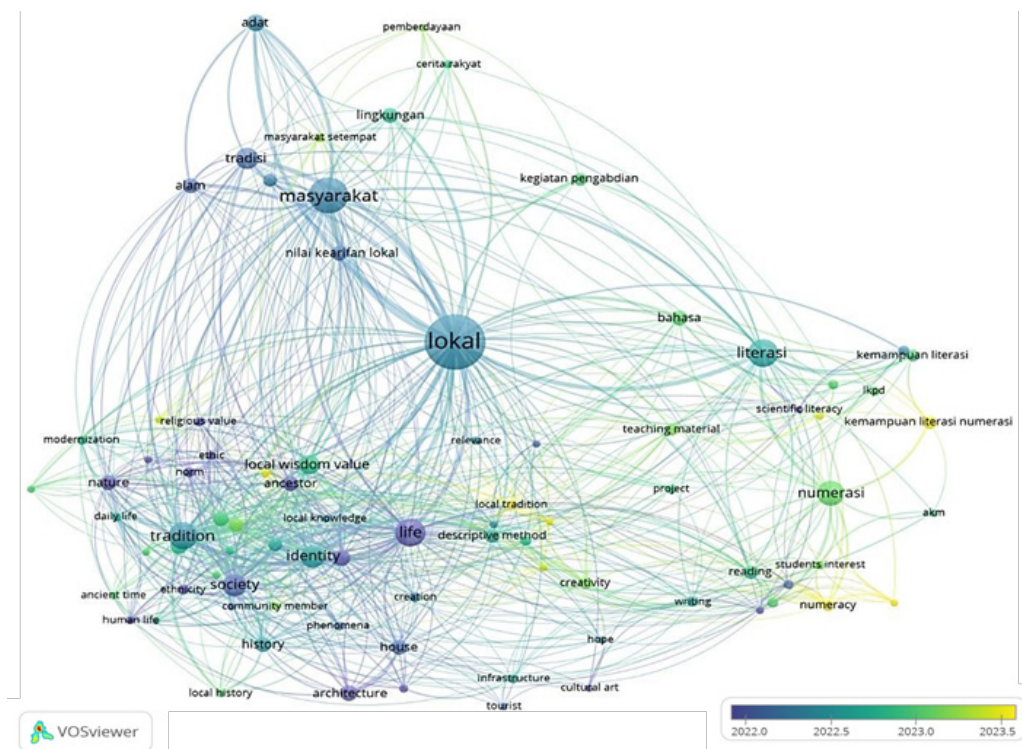
Generally, these four clusters show that science education research trends are not only oriented towards scientific content, but are also rooted in the cultural, social-context and local educational innovation. The inter-connectedness of the clusters indicates that a multidisciplinary approach combining science, literacy, culture and innovation is becoming an increasingly reinforced direction in recent scientific publications. The findings demonstrate the close interconnections between science education, strengthening cultural identity, numeracy-literacy, and technology-based learning innovation and creativity.

Based on the overlay visualization generated through VOSviewer in Figure 3, it can be identified the temporal trend of keywords in publications related to local wisdom-based science education in the range of 2020 to 2025. The visualization from Figure 3 illustrates the development of the research focus over time through the gradation of keyword colors, with purple to blue representing the dominant topics discussed at the beginning of the analysis period (around 2022), while green to yellow indicate more recent topics (2023 and above). Overall, research on science education based on local wisdom has shifted from a conceptual approach and cultural values to a more applicable and strategic direction. Therefore, developing teaching materials that are practical to use in learning has its own urgency.

In the early phase, many studies emphasized the meaning of local culture as a foundation for science learning, which is reflected in the occurrence of keywords such as community, tradition, custom, and local wisdom value. This shows the importance of preserving traditional values through education and utilizing local wisdom as a contextual learning resource. Furthermore, in the middle of the period (around 2022 to early 2023), there was a shift in focus towards a more applicable direction, marked by the appearance of keywords such as environment, scientific literacy, teaching materials, and creativity. This change indicates increased attention to the development of locally- based learning tools to sup-

port students' scientific literacy. As for the latest period, indicated by yellow keywords such as numeracy, literacy skills, students' interest, students'

worksheet, and students' assesment, research began to lead to strengthening basic literacy and numeracy skills.



**Figure 3.** Overlay visualization results from 2020-2025 publications related to culture, local wisdom, literacy, and numeracy by VOSviewer.

These findings reflect that local wisdom-based education is not only seen as a cultural approach, but has also moved towards integration with the basic competencies of the 21st century. The temporal visualization also shows a shift from a conceptual approach to the development of teaching tools and teaching strategies that are more applicable.

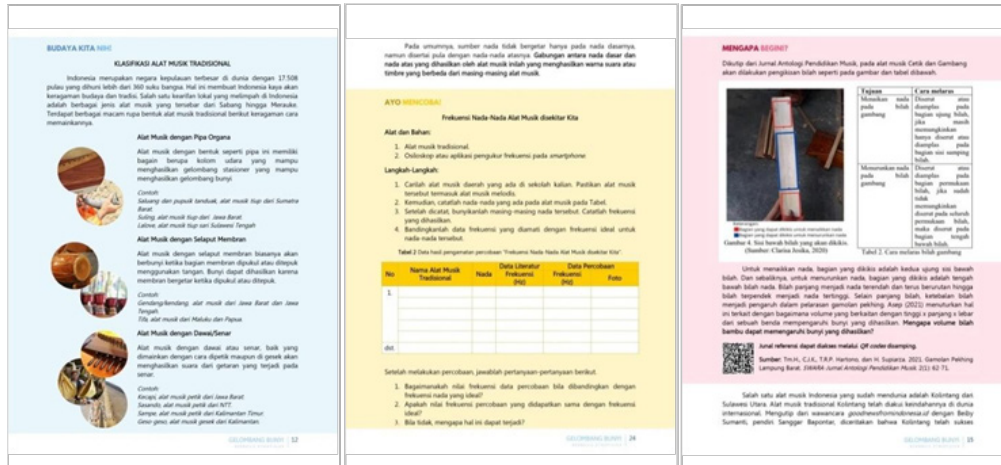
### Characteristics of Local Wisdom-Based Teaching Material

The Local Wisdom-based Sound Waves Teaching Material have been developed in accordance with the writing guidelines issued by the Badan Standar Nasional Pendidikan (BSNP). The teaching material has a total of 45 pages, with 10 subchapters. Certain elements are facilitated by the incorporation of specific features within the developed teaching materials shown in Figure 4.

The “Budaya Kita Nih!” feature, which translates as “Our Culture!”, contains articles and readings related to physics material based on local wisdom. This particular feature has been meticulously designed with the express intention of facilitating enhancement in reading literacy

among students. In this feature, local wisdom-based texts were presented in order to establish the linkage between physics, particularly in the domain of sound waves, and Indonesian culture. The “Ayo Mencoba!” feature, which translates as “Let’s Try!”, includes experiments related to sound waves. The experiments are presented in a simplified format to facilitate independent execution by students. This feature has been developed to assist students in the process of formulating scientific conclusions from mathematical data. The development of this feature was initiated with the objective of providing assistance to students in enhancing their literacy and numeracy skills.

Furthermore, the “Mengapa Begini?” feature, translated as “Why like this?”, comprises questions designed to evaluate the qualitative comprehension of concepts. This feature facilitates the observation of students’ comprehension levels. The purpose of these features is twofold: firstly, to enhance students’ understanding of physics principles, and secondly, to promote critical thinking. It is evident that a more comprehensive concept would facilitate a more effective analysis of the local wisdom-based physics material.



**Figure 4.** The features in Local Wisdom-Based Sound Waves Teaching Materials, which are a) “Budaya Kita Nih!”, b) “Ayo Mencoba!”, and c) “Mengapa Begini?”

The features developed in the teaching materials are designed to support the local wisdom learning process that occurs in the classroom shown in Table 4.

**Table 4.** Integration of local wisdom-based teaching materials with the discovery learning syntax used in local wisdom-based learning approach

Syntax of Discovery Learning Model	Teaching Material's Features	Achievement Indicator
Stimulation	“Budaya Kita Nih!”	Able to build students’ interest and motivation in learning the topic of temperature and heat. Students look enthusiastic in participating in learning.
Problem statement or identification	“Budaya Kita Nih!” “Ayo Mencoba!” “Mengapa Begini?”	Students are given problems related to sound waves material. Students are able to identify questions or problems to be investigated. Students are able to make temporary conjectures to answer the problem based on initial understanding.
Data collection	“Budaya Kita Nih!”	With guidance and direction from the teacher, students are directed to conduct experiments that can answer the problems presented. Students are able to find relevant information or data to test the hypothesis.
Data processing	“Budaya Kita Nih!” “Ayo Mencoba!”	Data processing is carried out by students. Students observe the experiment and collect the mathematical data obtained. Students are able to use and process the data found to get new findings.
Evidence	“Budaya Kita Nih!” “Ayo Mencoba!”	With the knowledge that students have and the data obtained from observations, students are able to interpret the experimental results correctly. Students are able to check their hypothesis. Students are able to discover concepts or theories.
Generalization or draw conclusions		Students are able to analyze the data collected and draw conclusions.

Indonesia’s cultural heritage can be utilized as a learning resource, especially with the support of increasingly sophisticated technological developments (Putri et al., 2020). Cultural diversity, such as local wisdom can be a new learning’s source for students, including in physics material. The characteristics of local wisdom-based learning in physics materials can be seen from several things, such as 1) there is a connection between

culture and physics, 2) physical science knowledge has benefits for everyday life, 3) local wisdom (indigenous knowledge) has a place in physics concepts, and 4) local wisdom-based learning is able to connect conventional knowledge to scientific knowledge.

The local wisdom-based teaching material, which has been developed, integrates the learning of physics with local wisdom knowledge. The ob-

jective of local wisdom-based learning is to examine the differences between indigenous scientific knowledge and scientific physics knowledge. In discovery learning local wisdom-based learning, students are encouraged to take an active role in identifying scientific knowledge that emerges from the local wisdom of the archipelago.

### **Validity of Local Wisdom-Based Teaching Material**

The validation local wisdom-based teaching material was conducted by physicists with expertise in educational material (lecturer) and physics teacher. The two validators concurred that the teaching materials could be employed with the incorporation of requisite revisions. Based on the validation sheet given to the validator, there are few categories scored such as aspects of content feasibility and presentation feasibility. The results of the teaching material validation sheet given to expert validator indicate that the content is highly feasible, with an average score of 3.70 or a percentage of 92.50%, meeting the criteria for very feasible content. The feasibility of the teaching materials' presentation was also deemed to be satisfactory, with an average score of 3.75 or a percentage of 93.75% in accordance with the very feasible criteria.

The validation results indicate that the teaching material demonstrates good to excellent quality in both content and presentation. The material is complete, in-depth, and accurate, aligning well with the competency standards and current developments in physics. Real-life examples, illustrations, and cases are used effectively to foster students' curiosity and support literacy development. The content is delivered in a systematic, coherent, and interactive manner, complemented by exercises, answer keys, and feedback. While certain elements, such as the currency of references and accuracy of data, may benefit from further refinement, the material is overall suitable for high school student.

In addition, the teaching material meets key criteria essential for enhancing students' reading literacy and literacy numeracy. Several things that must be considered, include 1) the text or reading presented is sufficient to represent the material presented, 2) the text or reading is presented interestingly, easily, clearly, on target, does not give rise to double meanings and is common in oral or written communication, 3) through information texts students can obtain facts, data and information to develop insight and knowledge, 4) and accuracy in choosing right dictions that suit communication needs (Pusat Asesmen dan

Pembelajaran Kemendikbud, 2020). This teaching material's criteria are reinforcing its effectiveness as a literacy-supportive resource.

### **Readability of Local Wisdom-Based Teaching Material**

Product trial group in small scale trial was given a cloze test at the end of the lesson. The cloze test was held to test the readability level of the teaching materials given to students. Based on the test results with the number of question items as many as 33 blanks, the average readability level was 76% with the lowest readability level of 64% and the highest of 88%. This percentage can be categorized by Bormuth (1971) standard's readability grade as teaching materials with a high level of readability that is easy to understand (Gajjar, 2024).

The results of the cloze test completed by the students indicate that the text presented in the teaching materials exhibits the following characteristics: 1) effective sentence structure, 2) vocabulary selection that aligns with the students' proficiency level, 3) logical and clear communication of information, and 4) absence of ambiguity due to double meanings. This is in accordance with the criteria of high-quality teaching material that must be met. In order to support students' reading literacy and numeracy, teaching material should be presented in an interesting, accessible, clear and on-target manner. It should avoid double meanings and be common in oral or written communication. In addition, it is imperative to select appropriate dictions that align with the specific communication requirements.

Study by Sufanti et al. (2024) addresses the issue of low early reading proficiency among students. It analyzes factors influencing reading difficulties in early-grade classrooms. In this study demonstrating the significance of well-designed teaching materials in early literacy. As stated by Zainuddin et al. (2023), the use of high-quality teaching materials can significantly improve students' literacy skills, underscoring their essential role in early literacy learning. Saputra et al. (2024) in other study also stated that well-structured teaching materials are crucial in supporting early literacy development, highlighting their essential role in modern educational settings.

### **Effectiveness of Local Wisdom-Based Teaching Material**

The results of the n-gain test, which were obtained from 60 students, are presented in Table 5. The n-gain result has already been tested significantly, with a t calculation of 9.41. This value



exceeds the t-table value of 2.064 with  $dk = 24$  and  $\alpha = 0.05$ . The effectiveness of teaching materials grounded in local wisdom was evaluated using quantitative data derived from pre-test and post-test scores. The present study sought to analyse the impact of a local wisdom-based discovery learning model on students' reading and numeracy literacy. As posited by Sugiyono (2021), the n-gain value indicated in Table 5 falls within the high effectiveness category, with  $\langle g \rangle \geq 0.7$  for the experiment group. In contrast, the control group demonstrates low effectiveness improvement, with  $\langle g \rangle < 0.3$ .

**Table 5.** The result of n-gain test on teaching material effectiveness conduct in experiment and control group

	Control	Experiment
Pre-test mean	29.43	31.51
Post-test mean	43.72	79.41
n-gain	0.17	0.70
Category	Low	High

In accordance with the results of the team analysis from the Pusat Penelitian Pendidikan (2021) on things that affect students' basic literacy, teachers' teaching strategies could affecting students' enjoyment of reading. In this aspect, innovation and also novelty in teaching materials that are specifically designed can improve student literacy. Literacy is a basic competency that is an important foundation in the learning process at various levels of education, including in science learning (OECD, 2023). As a basic competency that is an important foundation in the learning process at various levels of education, literacy requires an approach that is relevant to the context of students' lives.

In this study, local wisdom-based approach was selected along with discovery learning model. In the preliminary research, conducted in several high schools using questionnaires completed by teachers, indicates that the discovery learning model is a suitable approach for implementing reading literacy and numeracy. The discovery learning model emphasizes the understanding of concepts, meanings, and relationships through an intuitive process to finally come to a conclusion. Students are expected to find their own answers to problems through the application of this discovery learning model (Yulianti, 2024). The purpose of applying this discovery learning model is very much in line with contextual learning which emphasizes to real life situations so that it can

encourage students to be able to apply it in their lives (Meutiawati, 2023).

Bruner (1961) in his publication said that the purpose of a teacher is to provide a strong understanding of a subject, but it is the person himself who will continue this understanding after formal schooling ends. It is this attitude and activity of continuing one's own understanding that will become more meaningful to a person. This attitude and activity of "figuring out" or "discovering" something for oneself seems to have the effect of making things more meaningful, thus becoming more accessible in memory. The use of local wisdom-based media can improve students' critical thinking. (Mulatsih, et al., 2023).

### Practicality of Local Wisdom-Based Teaching Material

The result of giving questionnaire to the students obtained a percentage value of 84%, which is categorized as practical to use. The result of giving questionnaire to the teacher obtained a percentage of 93.5%, which is categorized as very practical to use.

Data on the practicality of using the local wisdom-based teaching material is in the form of quantitative data derived from questionnaires completed by teachers and students. Practicality of using the local wisdom-based teaching material by the teacher obtained percentage value of  $85\% < P \leq 100\%$ , which is considered in very practical to use category. On the other hand, practicality of using the local wisdom-based teaching material by the students obtained percentage value of  $70\% < P \leq 85\%$ , which is considered in practical to use category (Alfiriani, 2024).

Based on the observations and the results of the questionnaire given to students, it can be seen that this local wisdom learning received a good response from students. Students seem enthusiastic and interested in the learning activities carried out. Enthusiasm and active involvement of students in learning is one of the signs of meaningful learning (Domu & Mangelep, 2019). Integrating local wisdom in learning is in accordance with the principles of constructivism, because local wisdom provides a meaningful context for students (Apriyani et al., 2022). According to constructivism learning theory, knowledge is built based on experience and interaction with the environment. Constructivism theory is a learning theory that states that knowledge is not passively received by students, but is actively built based on their experiences and interactions with the environment (Budyastuti & Fauziati, 2021).

Constructivism theory is often associated

with figures, such as Jean Piaget with cognitive development theory and Lev Vygotsky with social and cultural learning theory. Each of these figures has a different view regarding constructivism theory (Suryana et al., 2022). This theory says that learning is an active process in which students build their own understanding by connecting new knowledge with previous experiences and knowledge (Sanjaya et al., 2022). This makes knowledge subjective. The knowledge obtained by students will be different depending on their personal experience (Salsabila & Muqowim, 2024). It emphasizes that knowledge is constructed by learners themselves through active engagement and interaction with their environment, connecting new information with prior experiences (Sugrah, 2019.). Study from Putri et al. (2024) analyzes the constructivist approach in public policy education, highlighting that students actively construct knowledge through experiences and social interactions. It underscores the importance of connecting new learning with existing knowledge frameworks.

According to this learning theory, learning will be student-centered and the teacher acts as a facilitator who helps students in exploration and reflection, not as the main source of information (Asmendri & Sari, 2018). Study from Muslikh et al. (2022) posits that learners build new knowledge by connecting it with their prior experiences, emphasizing the active role of students in the learning process. In addition, according to constructivism theory, knowledge is more meaningful if it is learned in a real context and relevant to students' lives. Constructivism learning provides space for exploration, discussion, and testing of ideas. Students are also given flexibility in using rich resources to support learning, such as manipulative tools, technology, or the local environment (Salsabila & Muqowim, 2024). In addition, it is possible to interact with local community figures or the surrounding environment (Suci, 2018). This can be a learning tool that supports the formation of social knowledge, in accordance with the theory of social constructivism proposed by Lev Vygotsky. Local wisdom can improve students' knowledge and attitudes (Uge, et al., 2019). Greater efforts from all parties are needed to maintain local wisdom and cultural identity through education. II et al. (2023) argues that the absence of efforts to maintain local culture leads to its gradual disappearance. The study from Istiqomah et al. (2023) concludes that collaboration between educational institutions and cultural entities is essential to maintain the continuity and relevance of local culture in the face of

globalization.

This study fills the gap that exists in the practical implementation of local wisdom-based teaching materials. Thus, this research not only provides innovation in culture-based learning approaches, but also makes a significant contribution to the fulfillment of national education targets, especially in improving students' literacy and numeracy skills. This research offers a pioneering example of how local wisdom can be systematically utilized to enhance fundamental literacies, which are deemed essential for student success in the 21<sup>st</sup> century.)

Education in the 21st century is no longer solely concerned with the memory-based retention of factual information, rather, it is focused on cultivating a range of essential skills. These include critical thinking, creativity, collaboration, communication, and cultural awareness. In Indonesia, the cultivation of these competencies is prioritized, one of which is through assessments like AKM, which emphasise literacy, numeracy, and character development.

The utilisation of local wisdom-based teaching materials has been identified as a key element in facilitating this educational transition, by rendering the learning process more meaningful and relevant to students' real-life contexts. The utilisation of culturally and environmentally relevant examples in the pedagogy of physics has been demonstrated to enhance student comprehension and application of scientific concepts. This approach has also been demonstrated to facilitate the enhancement of literacy and numeracy skills, encompassing activities such as reading, interpreting data, problem-solving, and reflecting on cultural values.

Moreover, the integration of local wisdom has been demonstrated to foster students' cultural identity, promote respect for diversity, and prepare them to face global challenges without losing their local roots. Consequently, this innovation is not only relevant but also essential in achieving the goals of 21<sup>st</sup> century education in Indonesia.

## CONCLUSION

The present study lends further support to the notion that the integration of local wisdom-based teaching materials is an effective pedagogical strategy for enhancing students' reading literacy and numeracy, particularly in the context of sound wave topics in physics. The developed materials demonstrated high validity, readability, and practicality, as well as a significant positive effect on student learning outcomes. These

results align with national education goals and emphasise the importance of culturally relevant resources in fostering deeper understanding and engagement.

In practice, the implementation of local wisdom in teaching materials has been shown to facilitate cognitive development, in addition to fostering the cultural identity of students and enhancing their critical thinking skills. The features embedded in the materials, including contextual texts, hands-on experiments, and reflective questions, have been shown to be effective in bridging scientific concepts with students' everyday experiences. It is recommended that future research explore the application of local wisdom-based materials across other physics topics and educational levels. Furthermore, longitudinal studies have the potential to yield insights into the long-term impact of such materials on literacy development and cultural awareness.

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